

## CLAIMS

### What is claimed is:

1. 1. A gypsum board, comprising:
  - a. a gypsum matrix having a bottom and a top;
  - b. a first facer sheet placed on the bottom of said gypsum matrix;
  - c. a second facer sheet placed on the top of said gypsum matrix;
  - d. one or more glass fibers placed within said gypsum matrix; and
  - e. an aqueous silane based sizing composition comprising nano or micro particles coating said glass fibers,
  - f. said coating being partially or fully cured to provide a roughened glass surface having said nano or micro particles bonded to said glass fibers prior to placement within gypsum matrix,said coating being operative to increase the strength, flexure resistance and nail pull resistance of said gypsum board.
2. A gypsum board as recited by claim 1, wherein each of said first and said second facer sheets comprises Kraft paper.
3. A gypsum board as recited by claim 1, wherein said gypsum matrix comprises calcium sulphate hemihydrate ( $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$ ), calcium sulphate anhydrite ( $\text{CaSO}_4$ ), hydraulic setting cement and water.
4. A gypsum board as recited by claim 1 wherein said aqueous silane based sizing composition coating comprises polymethylsiloxane and cured at 100 to 150 °C.
5. A gypsum board as recited by claim 1 wherein said nano or micro particles in the aqueous silane based sizing composition coating comprise colloidal silica.
6. A gypsum board as recited by claim 1 wherein said nano or micro particles in the aqueous silane based sizing composition coating comprise colloidal clay composition.

7. A gypsum board, comprising:
  - a. a gypsum matrix having a top and a bottom;
  - b. a first facer sheet placed on the bottom of said gypsum matrix;
  - c. a second facer sheet placed on the top of said gypsum matrix;
  - d. at least one mat composed of glass fibers coated with a silane based sizing composition comprising nano or micro particles coating said glass fibers,
  - e. said coating being partially or fully cured to provide a roughened glass surface having said nano or micro particles bonded to said glass fibers;
  - f. said glass fiber mat, and being disposed within said gypsum matrix before said board is subjected to a curing process,said coating on glass fiber mat being operative to increase strength, flexure resistance and nail pull out resistance of said gypsum board.
8. A gypsum board as recited by claim 7, wherein each of said first and said second facer sheets comprises Kraft paper.
9. A gypsum board as recited by claim 7, wherein said gypsum matrix comprises a gypsum mix including calcium sulphate hemihydrate ( $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$ ), calcium sulphate anhydrite ( $\text{CaSO}_4$ ), hydraulic setting cement and water.
10. A gypsum board as recited by claim 7 wherein said aqueous silane based sizing composition coating comprises polymethylsiloxane and cured at 100-150 °C.
11. A gypsum board as recited by claim 7 wherein said nano or micro particles in the aqueous silane based sizing composition coating comprise colloidal silica.
12. A gypsum board as recited by claim 7 wherein said nano or micro particles in the aqueous silane based sizing composition coating comprise colloidal clay composition.
13. A process for manufacturing a gypsum board, comprising the steps of:
  - a. mixing a sizing coating composition comprising a silane based composition and nano or micro particles;

- b. coating the said sizing coating composition onto a plurality of glass fibers;
  - c. partially or completely curing said sizing coating composition by subjecting said coated plurality of glass fibers to heat, thereby bonding said nano or micro particles to said glass fibers;
  - d. forming an aqueous slurry comprising at least one member selected from the group consisting of anhydrous calcium sulfate, calcium sulfate hemihydrate, hydraulic setting cement and water;
  - e. mixing said coated cured plurality of glass fibers and with said aqueous slurry;
  - f. distributing said aqueous slurry to form a layer on a first facer;
  - g. applying a second facer onto the top of said slurry layer;
  - h. separating the resultant laminate into individual gypsum boards; and
  - i. drying said gypsum boards during a gypsum cure cycle.
14. A process for manufacturing a gypsum board, comprising the steps of:
- a. mixing a sizing coating composition comprising a silane based composition and nano or micro particles;
  - b. coating the said sizing coating composition onto a glass fiber mat;
  - c. partially or completely curing said sizing coating composition by subjecting said coated glass fiber mat to heat, thereby bonding said nano or micro particles to said glass fibers;
  - d. forming an aqueous slurry comprising at least one member selected from the group consisting of anhydrous calcium sulfate, calcium sulfate hemihydrate, hydraulic setting cement and water;
  - e. distributing said aqueous slurry to form a layer on said first facer;
  - f. incorporating organized structures including mats of partially or completely cured silane based sizing composition with nano or micro particles coated reinforcing glass fibers into said aqueous slurry layer;
  - g. applying said second facer onto the top of said slurry layer;
  - h. separating the resultant laminate into individual gypsum boards; and
  - i. drying said gypsum boards during a gypsum cure cycle.
15. A gypsum board as recited by claim 1 wherein said nano or micro particles in the aqueous silane based sizing composition coating comprise alumina.

16. A gypsum board as recited by claim 1 wherein said nano or micro particles in the aqueous silane based sizing composition coating comprise carbon.
17. A gypsum board as recited by claim 7 wherein said nano or micro particles in the aqueous silane based sizing composition coating comprise alumina.
18. A gypsum board as recited by claim 7 wherein said nano or micro particles in the aqueous silane based sizing composition coating comprise carbon.